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ABSTRACT

Educational Facilities Laboratories is developing a computer-based technical service--The Public Schools Energy Conservation Service (PSECS). As presently envisioned, PSECS would be capable of providing each participating district with information in five areas: (1) guidelines and instruction for establishing an energy usage data base; (2) a comparison of the energy usage at each of the district's plants with guidelines established by computer simulations and a nationwide data base of similar schools; (3) a "self-help" plant operations audit; (4) a cost-benefit analysis of modifications requiring capital investments tailored to each school plant; and (5) guidelines for monitoring the results of district decisions in each area of modifications. (Author/MLF)

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AMERICAN ASSOCIATION OF SCHOOL ADMINISTRATORS
108th Annual Convention
Atlantic City, N.J. February 20-23, 1976

SPEAKER: John R. Boice, Director, Educational Facilities Laboratories, West, Menlo, CA.

TOPIC: Conserving Energy in School Buildings

PLACE: Edwardo Room, Howard Johnson

TIME: 2:30 pm, Saturday, February 21

PROGRAM: Page 48

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INFORMATION ABOUT
THE PUBLIC SCHOOLS ENERGY CONSERVATION SERVICE (PSECS)

Educational Facilities Laboratories is a nonprofit organization created in 1958 by the Ford Foundation to help schools and colleges improve their facilities and equipment. EFL's concern with current physical facility problems has led to many innovations in planning, design and construction. More recently EFL has been concerned with such current problem areas as the effect of declining enrollments, planning to accomodate the handicapped, development of the community/school center, and the conservation of energy in educational buildings.

During the past three years EFL has undertaken a number of activities designed to provide decision makers with the information necessary to make intelligent decisions with respect to energy conservation practices. This effort began in 1973 with the publication of EFL's Economy of Energy Conservation in Educational Facilities, a document that provides a basic introduction to energy conservation problems, and life-cycle cost analysis.

In order to provide specific data on the effect of various design and operating decisions on both cost and energy consumption, EFL began a series of energy conservation workbooks. The first of these, Energy Conservation and the Building Shell, was published in 1974. In order to provide real life examples of the implications of energy conservation practices, EFL also published Case Studies of Energy Use-Elementary and Secondary Schools.

In September 1974 EFL, in partnership with The Federal Energy Administration, began the development of a Public Schools Energy Conservation Service. The following pages present, in brief form information on the PSECS Project.

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THE PUBLIC SCHOOLS ENERGY CONSERVATION SERVICE (PSECS)

In September 1974 EFL began to develop what is now called The Public Schools Energy Conservation Service. While the project is still developing many aspects of the system, the basic form of how the service could operate has been formulated. What is presented here may well undergo considerable modification as we proceed with further testing of the assumptions and procedures.

The Projects Basic Assumptions.

1. Schools have certain basic characteristics that are similar enough to allow their classification into a few basic generic types.

2. Models of each generic type can be developed that will simulate actual operation of each.

3. "Adjustment Curves" which allow the calculation of desirable levels of consumption adjusted for such variables as; location, climate, use pattern, etc can be developed using the computer models.

Building on these assumptions, EFL has developed a computer based technical service designed to help school districts help themselves. A key objective in developing the service has been to keep the inputs to the system simple enough, so that any district regardless of size, or sophistication, could afford the time and money required to make use of the system.

How PSECS May Operate.

While the system is still in the development stage, and therefore subject to revisions, as presently envisioned, the service would be capable of providing each participating district with information in five areas:

(1) Guidelines and instruction for establishing a district wide energy usage data base.

(2) A comparison of the energy usage at each of the districts plants with minimum wastage guidelines established by computer simulations and a nation wide data base of similar schools.

(3) A "self-help" plant operations audit prepared with computer assistance for each school, which should allow the district to reduce plant energy usage to guideline levels.

(4) A cost/benefit analysis of modifications requiring capital investments tailored to each school plant.

(5) Guidelines for montoring the results of district decisions in each area of modifications.

A district may, at its' option, participate in any or all of these five phases of the service.

In order to make the Service available to school districts as quickly as possible, the first years efforts were concentrated on development of a complete program for elementary schools. The basic development work for all three elementary school generic types has now been completed, and is ready for more wide spread testing.

The Federal Energy Administration has agreed to provide limited funding for further test marketing of the elementary school package in selected school districts in order to refine the process, determine the costs involved in operating the Service, and further develop procedures that can be used in full-scale marketing activities.

The objective of the Service is to inform a district (1) where each of its' schools now stands with respect to energy use, (2) where the guideline indicates the school should be, and (3) how to go about getting their school to conform to guideline levels. The activities involved in this process are shown on the following page: Very simply it works as follows:

1. The district completes a questionnaire which provides the Service with some basic information about each school to be analyzed. Experience to date indicates that it takes only one to two hours per school, to complete this questionnaire.

2. PSECS makes comparisons between each of the schools submitted, and its' guidelines for a plant of that type, operating on the schedule provided in that climate.

3. The results of these comparisons are returned to the district by means of computer printouts. The first of these provides a summary report on energy use, and savings possible for all schools submitted, allowing a district to quickly spot problem schools. A more detailed report on each school is also provided.

4. To assist the district in determining the cause of excessive energy use, the Service also can provide materials for the district to make a Self-Audit of any or all of its' schools.

5. In addition to the Self-Audit which involves no capital modification, PSECS has a Capital Modification Program which analyses a number of improvements on a cost benefit basis.

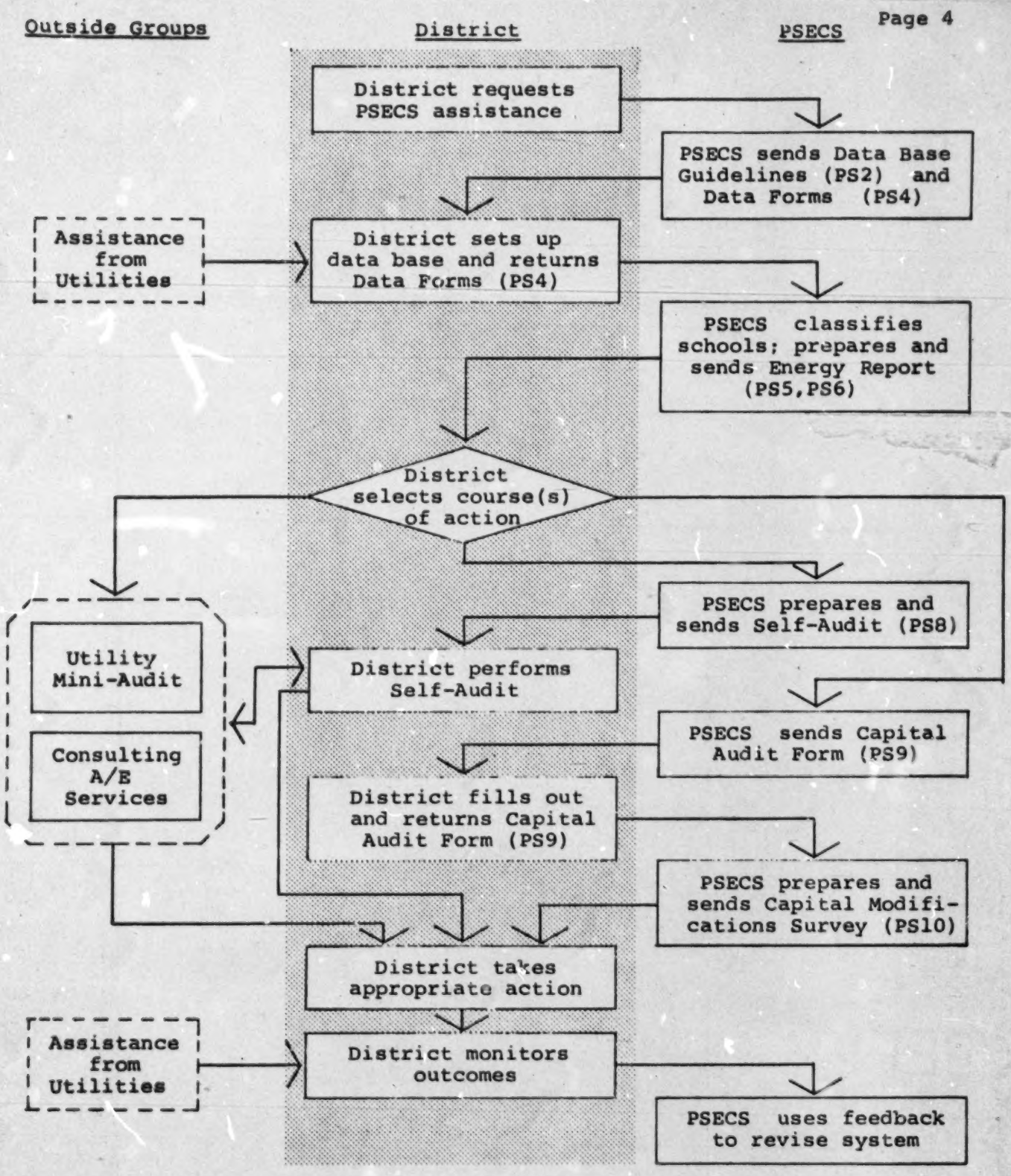
Outside Groups
District
PSECS
District requests PSECS assistance
PSECS sends Data Base Guidelines (PS2) and Data Forms (PS4)
Assistance from Utilities
District sets up data base and returns Data Forms (PS4)
PSECS classifies schools; prepares and sends Energy Report (PS5,PS6)
District selects course(s) of action
PSECS prepares and sends Self-Audit (PS8)
Utility Mini-Audit
Consulting A/E Services
District performs Self-Audit
PSECS sends Capital Audit Form (PS9)
District fills out and returns Capital Audit Form (PS9)
PSECS prepares and sends Capital Modifications Survey (PS10)
District takes appropriate action
Assistance from Utilities
District monitors outcomes
PSECS uses feedback to revise system

Figure 10

PSECS Process

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About Generic Types

The service is able to provide approximate computer simulation of energy use at individual plants, by making use of essential similarities of plant characteristics, and patterns of use found in most American schools. The basic similarities of school plants built during given periods of educational, and architectural philosophy, and technology, permit the grouping of plants into generic types, based on their physical characteristics. Analysis of energy use indicates that these generic types also determine classes of energy usage--that is, all plants of a given generic type seem to have similar energy use characteristics. A similar situation exists for patterns of building use.

While there will be some schools that will not fit into any of our generic classes, the majority of the schools in the U.S. can be so classified, using this system (see page 6).

About "Self-help"

A second reason why the service can function at low cost, is the philosophy of district self-help. PSECS will provide information which, if seriously and appropriately used, will result in major energy and cost savings. The district must provide the input data which activates the system, and interpret, and apply the results of the analysis. An effort has been made to keep requirements of district involvement at the minimum level appropriate to the needs of the service.

In order to permit maximum flexibility of district response, a variety of district options are supported by the service. Where district resources and desires favor this, the service can act in support of energy conservation efforts involving utilities and consulting engineering services. The service is, of course, capable of providing a fairly comprehensive program on its own. Some stages, such as the implementation of capital improvements, involve design and construction professionals in their traditional roles.

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PSECS GENERIC TYPE DESCRIPTIONS

Types 10 and 12 - Pre-World War II Plants

Type 12 has mechanical cooling.

Dates of completion:	1920 to 1940
Plan type:	double-loaded corridor
Construction:	heavy frame and walls
Mechanical systems:	hot water or steam boiler radiation type systems (some unit vents)
Lighting:	original incandescents now largely replaced with fluorescents
Classroom glass:	40 to 60 per cent of exposed wall

Type 19 - Mix of Types 10 or 12 and 20 or 22

Types 20 and 22 - Post-War ("finger plan") Plants

Type 22 has mechanical cooling.

Dates of completion:	1945 to present
Plan types:	single- or double-loaded corridor
Construction:	light frame (single-story) heavy frame (urban and multi-story)
Mechanical systems:	hot water boiler unit ventilator or similar type systems
Lighting:	incandescent (ring) or early fluorescent now largely upgraded to fluorescent
Classroom glass:	up to 90 per cent of exposed wall

Type 29 - Mix of Types 20 or 22 and 30 or 32

Types 30 and 32 - Artificial Environment Plants

Type 32 has mechanical cooling.

Dates of completion:	about 1965 to present
Plan type:	compact
Construction:	as Type 20
Mechanical systems:	sophisticated air-handling types, such as single- or double-duct, multizone, variable air volume, etc.
Lighting:	high level fluorescent
Classroom glass:	less than 15 per cent typical

Type 38 - Mix of Types 10 or 12 and 30 or 32

Type 39 - Mix of Types 10 or 12, 20 or 22 and 30 or 32

NOTE: PSECS computer models permit interchange of characteristics between types in some areas, such as a Type 10 building with a ducted mechanical system or a Type 30 with high classroom glass percentage.

Advantages of Participation

PSECS offers to participant school districts a chance to make significant improvements in the energy consumption of their school plants, while assisting in the development of a program that will benefit districts throughout the nation. In addition to the direct value of an energy savings analysis of each plant, as described in preceding sections, PSECS will also make use of input data to refine the guidelines reflecting the typical energy consumption levels of various types of schools.

Finally, as a nation-wide clearinghouse receiving information, suggestions and data from school districts in all parts of the country, PSECS will be able to provide energy conservation advice based on the broadest possible data base.

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